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AN

INAUGURAL DISSERTATION,

SHEWING IN WHAT MANNER

PESTILENTIAL VAPOURS

Acquire their *acid* Quality, and how this is neutralized and destroyed by

ALKALIES.

SUBMITTED TO THE PUBLIC EXAMINATION OF THE
FACULTY OF PHYSIC, UNDER THE AUTHORITY
OF THE TRUSTEES OF COLUMBIA COLLEGE,
IN THE STATE OF NEW-YORK,

WILLIAM SAMUEL JOHNSON, LL. D. President.

FOR THE DEGREE OF

DOCTOR OF PHYSIC,

On the 2d Day of May, 1798.

By ADOLPH C. LENT,

Citizen of the State of New-York.

CNOMES! to impede the DEMON's deadly course,
YOUR BANDS CELESTIAL marshall'd all their force:
From wat'ry caves where shelly nations sleep,
From sinuous bays, from Ocean's briny deep,
Your hands collecting spread thro' every clime,
A fair proportion of attempering LIME;
'Thro' all the space terrestrial Nature owns,
Of Climates, Colures, Longitudes and Zones,
Your search the powerful ALKALIS has found,
And cast, the Earth's circumference around;
The friendly powers of METAL, OIL and CLAY,
With dutious zeal your just commands obey;
With wise dispatch their various stations gain,
And guard the Mine, the Mountain, and the Plain.

MITCHILL.

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—1798.—



INTRODUCTION.

General Ideas of the Disorganization of Bodies after Death.

ALL animal and vegetable bodies, deprived of the principle of life, undergo certain changes, by which their texture becomes destroyed, and their composition altered; having lost the chemical affinity subsisting between their elementary principles in their living state. The process by which this decomposition is effected, which renders more simple the compounds formed by vegetation and animalization, and causes them to enter into new combinations of different kinds, is named putrefaction, and is determined by the same causes, agents, and circumstances, in both, viz. oxygenous air, caloric, and water. Upon a proper application of these agents does the more rapid or slow dissolution of these bodies depend. Animal substances, composed of hydrogen, carbon, oxygen, and septon (azote), and not unfrequently still more complex by the addition of sulphur, phosphorus, iron, lime, and soda, when deprived of that constitution which imparts to them life, and exposed to the influence of these agents, are soon altered by more simple attractions between their elements, which most generally have a tendency to unite in binary

or ternary combinations. This new association between their principles gives rise to new bodies, such as septous (azotic) air, oxyd of septon (azote), septous acid, septic gas, septic acid, septic acid gas, carbonic acid gas, hydrogenous gas, oxygenous gas, carbonated, sulphurated, and phosphorated hydrogenous gas, soda, water, and perhaps ammonia, which gradually escape into the atmosphere, proportionally diminishing the putrifying mass. Upon the union of these elements all the changes resulting from the putrefaction of animal bodies depend. In the union of septon (azote) and oxygene, *according as the acidifying principle unites with septon in a greater or less quantity*, we perceive the formation of septous gas, and the oxyd of septon, septous and septic acid, and septic acid gas; to the production of which it is well known how much animal substances contribute; as in nitre-beds, graves, ditches, puddles, &c. and in all those places where putrefaction takes place to any large amount. The combination of carbon and oxygene with caloric, explains the generation of carbonic acid gas. The carbon and hydrogen may unite in the form of fat, or that substance so often described as resembling spermaceti; and if ammonia is formed, it will proceed from the union of septon with hydrogen. It is possible, also, in bodies containing sulphur and phosphorus, these acidifiable bases may unite with oxygene, and form their respective acids. Where lime (calcareous earth), soda, or iron, is extricated by putrefaction, these bases may attach the carbonic, septic, sulphuric, and phosphoric acids, and form

carbonates, septites, sulphats, and phosphates of lime, soda, and iron. These are the products, liable, however, to variation, which are evolved on the putrefaction of animal substances. It may happen that all, or a greater part of the septon, may combine with caloric, and fly off in this state in the form of septic gas: on the contrary, all the septon may unite with oxygene, and be converted into septic acid. The same variations may take place in the other combinations, according as the elementary principles get within the spheres of each other's attraction, and according to the varying proportions of the agents above enumerated.

The products which obtain, on the decomposition of vegetables, are nearly the same with those of animals; except that the compounds, into which septon, sulphur, and phosphorus enter, are not so often formed; nor are the septic compounds produced in so great plenty, owing to a less quantity of septon in the latter than in the former substances;—the greater part of vegetables containing little or none, though others are furnished plentifully with it. Vegetable substances, though liable to undergo disorganization, are not so much so as animal; their order of composition being less complex: neither do they afford so much septic gas when acted upon by the septic acid, nor contribute in so eminent a degree to the formation of this acid. These different appearances between the two substances, and the more rapid decay of animal bodies, seem to depend on the presence of one elementary principle only, namely, septon, being in a greater

abundance in animal than in vegetable substances. It appears probable, therefore, that by the addition of this principle to vegetable matter, it may be made to possess similar qualities with that of animal; and by depriving the latter of its septon, it will become, in some measure, vegetable. This may be termed the capital difference between the two substances: but other phenomena, whose influence on the animal composition is, no doubt, inferior, ought likewise to be noticed; such as the phosphoric acid, and its combinations with lime, ammonia, and soda; the quality of the residue of animal matter, after dissolution, being principally owing to these combinations.*

* Vide Fourcroy's *Philos. of Chemistry*, p. 162, 163.

CHAPTER I.

*Relations of the Products of Animal and Vegetable
Decomposition to other Bodies.*

ANIMAL and vegetable matter having been shewn, on dissolution, to give rise to new compounds, such as the septic oxyds and acids, &c and as all living systems, whether of plants or animals, must lose the principle by which their life is continued, and become disorganized, the quantities of those gaseous fluids which are naturally formed and diffused through the air in such processes, must be immense, and exceed ordinary estimation. From the perpetual accumulation of these gaseous bodies, it would seem the respirability of the atmosphere must, within a short period, become destroyed, and, from the noxious and even poisonous qualities of certain of these gases, such as the septic compounds, acquire a deleterious and destructive operation on the constitution of man, and other animals who live and move in it. This, from appearances, would really happen, were it not that these gaseous substances did again enter into union with certain other bodies, on coming within the spheres of their attractions, by which they are taken out of circulation, and become fixed or decomposed.

1. In this manner the oxyd and acid of septon, on meeting with certain bodies, are taken out of circulation, and become fixed or neutralized, and thus restrained from exercising their deleterious

qualities, which, if left to pervade the atmosphere, would, on meeting the bodies of men, carry on their destructive and corroding operation, and produce diseases of different grades and malignancy, in proportion as the attendant circumstances, and the constitution of each, were more or less favourable to their operation.—The principal of those bodies which have the power to coerce and restrain this acid, is pot-ash, or the vegetable alkali, also called salt of wormwood, and salt of tartar, with which the acid unites, and forms the septite of pot-ash, commonly known by the name of salt-petre, or nitre, from which this acid has derived the name hitherto most commonly affixed to it. This saline substance, afforded by the combustion of plants, has the strongest attraction of all bodies present, where putrefaction takes place, for the septic acid,* and will, consequently, disengage the acid from all other bodies with which it is united, and attract it itself.—There are certain soils and tracts of country, as in Spain, Persia, and the East-Indies, where pot-ash is native, and by absorbing from putrid and all other bodies with which they meet, all the acid they contain, they change to septite of pot-ash (nitre). Where this substance is not naturally present, it is frequently accumulated from adventitious circumstances; near the habitations of men it is generally produced by the agency of fire; and large quantities of it, dissolved in water, are continually thrown away with such solutions as have

* Vide Bergman's Tab. of Elec. Attrac.

been employed to aid common water in cleansing, and answering the purposes of washing.* In such instances, where there is no pot-ash present, or there is more of the acid than it is capable to neutralize, it may be arrested by the muriate of soda (common or culinary salt), which is consumed in large quantities by men and brute animals. The alkaline basis of the salt having a stronger attraction for the septic than muriatic acid, it will dissolve its connection with the latter, and form a union with the former, in the form of septite of soda (cubic or quadrangular nitre). This acid likewise unites readily with calcareous earth (lime), converting it into a septite of lime (calcareous nitre). From the greater abundance in which lime is found in and about human dwellings, old walls, sinks, drains, &c. than either of the above alkalies, it might be presumed, that this acid, in conjunction with calcareous earth, would very commonly obtain. This is found to happen. The nitrous quality of old walls, plaistered with lime, which takes place even to such an extent, as to have become worthy the attention of persons engaged in the manufacturing of nitre, is sufficient evidence of the strong affinity which subsists between it and the acid; at the same time proving this acid to be present within and around human dwellings, in considerable quantity. Clay likewise has an affinity

* See a calculation, made by Professor MITCHILL, of the immense quantity of this alkali dissolved in water, which is, from time to time, thrown out in large and populous cities, in *New-York Mag.* for January, 1797, p. 9.

for this acid; and in such walls where lime is one of the ingredients, and becomes saturated with the septic acid, the clay will unite with it, and be converted into an argillaceous septite (aluminous nitre). Its affinity, however, is in so weak a degree, that where either of the alkalies, or lime, is present, its union with the acid will be prevented, or dissolved, if made. This acid also unites with the volatile alkali, for which, next to the fixed alkalies and lime, it has the greatest attraction; but from the rare occurrence of this alkali in the earth, it will rarely happen that a septite of ammonia is formed. Fat, or oily substances, will likewise unite with this acid, and that with such rapidity as to burst into flame with many kinds of oils. “The action of the nitric (septic) acid on most inflammable matters, consists in nothing more than a continual decomposition of this acid.”—“The nitric (septic) acid, when mixed with oils, renders them thick and black, converts them into charcoal, or inflames them, according as the acid is more or less concentrated, or in greater or less quantity.”* From the experiments of Margraff and other chemists, this acid was also found in rain and snow waters; and from the disposition of water to enter into union with it, may it be learned how rain-water in showers acquires the unwholesome qualities which, in certain instances, it has been observed to exert on the constitution.

Hence, then, it appears, that the alkalies, calca-

* Fourcroi, &c. Chaptal's Chemistry, p. 133, &c.

reous earths, clay, oils, and water, on meeting the septic acid, act in a beneficial manner, by repressing and keeping down this fluid, which, by rising in the atmosphere, and pervading human dwellings, &c. might occasion intermittent, or other fevers of a more malignant or pestilential nature.

2. Carbonic acid (fixed air), which is so plentifully formed during the putrefactive process from animal and vegetable bodies, by reason of its greater specific gravity, never rises to any great height in the air, but descends to the surface of the earth, where it may either be absorbed by lime, or may contribute to the nourishment of plants, which possess the power of decomposing and absorbing it, when in a small quantity.*

3 and 4. The hydrogen, or inflammable gas, that is sometimes extricated during putrefaction, escapes, and mingles in the air with other gases, with some of which, more especially the oxygenous it may unite, and form water; while the oxygen gas that is set loose in certain instances, may ascend and replenish, in part, the perpetual waste which this fluid, from combustion, respiration, &c. must necessarily suffer, from time to time, in the atmosphere.

5. The other gaseous compounds, to which the disagreeable smell and phosphorescent appearance attending vegetable and animal putrefaction are principally owing, may combine with certain bodies they meet with, or ascend in the atmosphere, from whence they may again be precipitated to the earth.

* Chapt. Chem. vol. iii. p. 32.

CHAPTER II.

Facts tending to shew the Connection between the Effluvia of putrefying Bodies, and malignant and pestilential Diseases.

FROM marsh exhalations and human effluvia, has it been believed, from the earliest ages of physic to the present time, that malignant and pestilential diseases derived their origin. Daily experience still confirms that it is in the neighbourhood of marshes, and all such places where vegetable and animal putrefaction takes place to any extent, that pestilential and other diseases of various grades and violence prevail. Epidemics, attended with carbuncles and buboes, which are denominated, in conjunction with the ordinary symptoms of what is called *jail* and *hospital* fever, the characteristics of the plague, down to the mildest intermittent, have appeared, and raged with extreme violence, occasioned by the exhalations from putrefying animal and vegetable substances.*.

The numerous facts and observations of the most judicious writers shew, that there are few climates where instances have not occurred of malignant epidemic and endemic diseases, occasioned by an atmosphere surcharged and poisoned with the effluvia exhaled from certain putrid vegetable and animal substances. Bengal, on both sides the river Ganges, and Egypt, annually overflowed by the

* Pringle on the Army, p. 321 and 322.

Nile, experience an unhealthy and pestilential atmosphere, immediately after the exhalations from the putrefying collections of vegetable and animal matter begin to arise in the air, and bring on diseases of various grades of malignancy, down to what is called the plague. The same occurs in every climate in a greater or less extent. In ponds, ditches, swamps, &c. where, after the evaporation of the water, the collections of vegetable and animal matter being left bare, and exposed to the influence of the sun, begin to putrefy, and emit certain gaseous exhalations, which transfuse themselves into the atmosphere, and produce diseases of an intermittent or more malignant type, proportionate to the concentrated state of the contagion, and other concomitant circumstances. Lind, whose testimony, from his experience, must equal most authors, relates abundance of instances where what is called *yellow fever*, and other malignant diseases, were caused by gaseous fluids, exhaled from low and marshy places, exposed to the influence of a powerful sun. He observes, that “ in all spots, in the East-Indies, situated near large swamps, or the muddy banks of rivers, or the foul shores of the sea, the vapours exhaling from putrid stagnated water, from the corrupted vegetable, and other impurities, produce mortal diseases.”* The same author more particularly mentions, that the *yellow fever* often raged at Greenwich Hospital, in Jamaica, which, he observes, was built near a marsh, and could not

* Lind on Hot Climates, p. 85.

proceed from any source of infection in the hospital. He every where attributes the *yellow fever* to the vapours arising from putrefying vegetable and animal substances.

Dr. Clark, in his *Observations on the Diseases of long Voyages to hot Countries*,* mentions a *contagious malignant* fever, which prevailed at Prince's Island, in 1771, produced from the exhalations of putrefying vegetable substances.

The plague which caused so great a terror and mortality in London, in 1625 and 1636, according to the account given by Mr. Woodal, surgeon to St. Bartholomew's Hospital, and surgeon-general to the East-India Company, who was present those two years during its prevalence, was evidently generated in that city, from the gaseous exhalations of putrid collections of animal and vegetable matter. He says, "the terrestrial causes (after mentioning it as a punishment inflicted on mankind for their sins,) are, by common consent of most writers, as followeth; venomous and stinking vapours, arising from standing ponds, or pooles, ditches, lakes, dunghills, sinks, channels, vaults, or the like; as also unclean slaughter-houses of beasts, dead carcases of men, as in time of war, and of stinking fish, fowl, or any thing that hath contained life and is putrid: as also, more particularly in great cities, as in London, the unclean keeping of houses, lanes, alleys, and streets: from those recited, and the like infectious venomous vapours, by warmth of the

* Vol. i. p. 123 and 124.

fun exhaled, are apt and able to infect the living bodies of men, and thereby to produce the plague, as experience too much sheweth.”* From the description given by Mead† of Grand-Cairo, the supposed harbinger of a species of the worst type of disease, the plague, it will appear to be produced by similar causes with the above case, viz. by certain gases formed on the putrefaction of vegetable and animal substances, and suffered to arise into and poison the circumambient atmosphere with their noxious and stimulating qualities. He says, “ it is situated in a sandy plain, at a foot of a mountain, which, by keeping off the winds that would refresh the air, makes the heat very stifling. Through the midst of it passes a canal, which is filled with water during the overflowing of the Nile, and, after the river is decreased, it gradually dries up. Into this canal the people throw all kinds of filth, carrion, &c. so that the stench arising from it, and the mud together, is insufferable. In this situation of things, the plague every year constantly preys upon the inhabitants, and is only stopt when the Nile, by overflowing, washes away the load of filth.”

Pringle, Jackson, Hume, and a number of other authors, might be added in further proof, that the effluvia from animal and vegetable putrefaction may give rise to, and are the common causes of malignant and pestilential diseases. Instances, abundantly numerous, occur in our own territory, to confirm the noxious and pestilential influence of

* Monro on the Army, vol. i. note to p. 223.

† On the Plague, p. 29 and 30.

the products just named, on their application to the constitution, notwithstanding the (so named) *facts*, which were promised *speedily to appear* almost a year since, in contradiction of this opinion. It is related by Dr. Reynolds,* that from the putrefaction of a horse, which lay on the borders of a marshy piece of ground, a young woman who lived near, and was obliged frequently to pass and repass the putrid carcase, was affected with violent pains in the head, and sickness at her stomach. On the second day of attack was bled, but her fever increased, and she became delirious. A number of blisters, surrounded by inflammation, appeared upon her feet and hands, fingers and toes; and she died the fourth day.

A case, a few years since, occurred in this city, where a severe attack of fever, of the remittent type, attended with petechiæ, made its appearance in two persons of the same family. On examination into the cause of these complaints, it was discovered, by the attending physician, to have originated from the blood and other offal of cattle, slaughtered in the yard belonging to the house, which was suffered to collect and putrefy, to the exhalations of which the two persons attacked had been, from time to time, exposed. An instance of a similar nature, which occurred to a practitioner of a neighbouring town, is related by Mr. Bayley, in his treatise on the epidemic of New-York in 1795.† “Some time in the month of September I was called to visit a young man about eighteen years old, in a family in

* Webster's Collection, p. 197.

† P. 84 & seq.

the skirt of the (Hartford) town. He was violently attacked with most of the characteristic symptoms of yellow fever, &c. The next day a second was taken in the same manner; and, on the morning of the third, three more were taken sick. This led me to suspect some particular cause. I searched for it in vain that time. The next morning, on passing through the kitchen, I smelt something that was very offensive, which none of the family had noticed. On opening the cellar-door, I found that it proceeded from the cellar. Two persons went down to examine, and found, in one corner of a small tight room, a quantity of June cabbages, on which the sun had shone about three hours in a day. They had rotted, and sunk down in a lump of putrefaction. They run a stick under them, and lifted them up, and there immediately issued such an intolerable stench, as obliged them instantly to leave the cellar. A vomiting was brought on at once, which lasted them nearly an hour. Notwithstanding that the doors and windows of the cellar were thrown open, it was two days before they could clear it out. No other person in the family was taken afterwards, and those who were already seized soon recovered."

The malignant epidemic, or yellow fever, which prevailed, in the summer of 1797, in Providence, Rhode-Island; in 1795, in Norfolk, Virginia;* and, in 1791, in New-York, evidently took their origin from gases exhaled from vegetable and ani-

* Webster's Collection, p. 148 & seq.

mal substances, suffered to collect and putrefy, on exposure to a heated atmosphere. It would be endless and unnecessary to add facts in further confirmation of the noxious and deleterious qualities of certain gases, formed from vegetable and animal putrefaction, on its application to the constitution. Those already related, as well as various other instances, sufficiently confirm, that the greatest degree of vitiation which the atmosphere manifests by its operation upon the constitution, proceeds from the effluvia emitted from certain vegetable and animal substances during putrefaction. And, as far as the innumerable facts on this subject have been collected and examined, there exists the most cogent evidence, that the products just named form infection, or contagion, marsh-miasmata, or human effluvia, or whatever other name has been affixed to it. What the precise nature of these exhalations, or cause of fevers, was, and which the particular noxious gas, though long a subject of inquiry, remained unknown, till, within a few years since, Mitchill, Professor of Chemistry, Natural History, and Agriculture, &c. in Columbia College, engaged in an investigation of its properties, made known to the world what that poisonous something, which is formed during animal and certain vegetable putrefaction, was. He discovered it to be a portion of septon (azote), one of the elements of the body undergoing putrefaction, united chemically with more or less of oxygene (the acidifying principle), in the form of septic (nitric) oxyd and acid.* On

* Vide Mitchill on Contagion.

the formation and presence of this compound, it is presumed, do pestilential and other malignant diseases depend. And, in proportion as a greater or less quantity of the above compound is formed; in proportion to its sparse or concentrated state; in proportion to the length of time, the susceptibility of the constitution to be operated upon, and the circumstances under which it is applied; will the diseases, depending upon this cause, be more or less violent, and attended with various pestilential symptoms.

CHAPTER III.

Inquiry into the History, Production, and Qualities, of that Acid which attends the Putrefaction of such Bodies as give Rise to malignant and pestilential Diseases.

SEPTON, the base of the acid of putrefaction, or septic acid, is one of the most abundant elements in nature: it has not hitherto been subjected to any examination by itself, as no experiments have been able to detect it in a distinct and separate state. In combination with caloric (the matter of heat,) it forms septic (azotic) gas, which composes nearly three fourths of our atmosphere, and is the same species of air which living plants are supposed to exhale in the night, according to Ingenhouz.* It likewise

* 2 Experiences sur, &c. sect. vii.

constitutes one of the elementary principles of certain plants : and, from the result of certain experiments made by Eagleton Smith, Esq.* appears to be one of the elements which compose animal poisons, as was, some time previous to this, presumed by Professor Mitchill. From the similar action on animals, of such animal poisons as were used by the experimenter, such as that of bees, ants, and some other insects, with the decoction of the poisonous plants, laurel, tobacco, digitalis, opium, &c. it appears highly probable, that their deleterious qualities are owing to a modification of this same principle, viz. septon. It also enters largely into the composition of the muscular fibre, blood, and lean parts of animals, in combination with carbone, hydrogen, and phosphorus, which are united together by a certain portion of oxygene, forming animal oxyds and acids, in proportion to the degree of oxygenation. This gas, in its pure and distinct form, is incapable to support respiration and combustion ; while it sustains the life of plants, which appear to possess the power of decomposing it, and to attach to themselves the septon, which enters into and constitutes one of their principles.† This principle, or element, is also capable of uniting with oxygene, the principle of acidity, forming with it, in proportion to the quantity of this last substance,

1. The gaseous oxyd of septon (dephlogisticated nitrous air) ;
2. Septic (nitrous) gas ;
- 3 and 4. Septous

* Vide Appendix A.

† Mitchill on Manures. Med. Repos. vol. i. No. 1.

and septic (nitrous and nitric) acids; and, 5. Septic acid gas.

1. In the first of these forms, that of the gaseous oxyd, in which the acidifying principle is so small as not to manifest the smallest degree of acidity, it is capable of supporting combustion, but is highly deleterious to the lives of animals, which it destroys the moment they are surrounded by an atmosphere of this kind.* 2 and 3. The next degree of combination of oxygene with septon, is the septic gas, and the septous acid. These are artificial productions, and never found to exist in the atmosphere for any considerable length of time, as their existence depends on being kept closed, and free from contact with the air. The rapidity with which they absorb oxygene from the atmosphere, on exposure, is so great as to become quickly saturated with this principle, and turn to septic acid. As their existence in the air is only momentary, unless kept from coming in contact with it, they can have no material influence on man or brute animals; and their qualities are so widely different from those of the more highly oxygenated form, the experiments and conclusions drawn from the two former, cannot apply to account for the phenomena of the latter. 4 and 5. The septic acid, which is still higher dosed with oxygene, and the septic acid gas, the highest degree of oxygenation of septon, the form in which these compounds most commonly exist, and which are produced wherever septon and oxygene

* Priestley on Air, vol. ii. p. 35.

come into chemical union, have, for a length of time, been considered of *mineral* origin, and classed among the acids of this kingdom. How far this opinion is founded in experience, and deduced from facts, will appear on examination of the materials, and sources, from whence it is derived. It is well known that nitre consists of septic acid joined to pot-ash, and is usually formed during the decay of animal and such vegetable bodies as contain septon. And it is ascertained, that septon and oxygen enter into the composition of those substances, when alive, and have gone into new combinations, on their disengagement, after death. One of these recent compounds must be septous and septic acid, constituting, by junction with a saline base, the septite of pot-ash. The theory of salt-petre thus necessarily presumes the generation of septous and septic acid, from two of the elements disengaged from organic texture. And as septon, the radical of the acid, is especially abundant in animal bodies, there is little difficulty in comprehending both how, in such circumstances, it attracts the acidifying principle, and afterwards attaches itself to the alkali. Nicholson observes it to be well known, that the septous acid, instead of existing in the mineral kingdom, is almost always produced by a concurrence of circumstances, chiefly consisting in the exposure of putrefying substances to the atmosphere; and that it is formed by the union of two principles, which are always found in atmospheric air, and the exhalations of putrefying sub-

stances.* The nitrous quality of the earths at the bottom of graves, in which animal disorganization has taken place, is further testimony of the origin of this acid, as in this case it could not have acquired its septic quality from any other source. Hence may be understood how other earths, such as those of stables, cow-houses, cellars, vaults, drains, sinks, &c. &c. acquire their nitrous quality. During the putrefactive process of such vegetable bodies as contain septon, and animal matter, which abounds in this principle, the oxygene derived either from the corrupting bodies themselves, from the water in or near them, or from the atmosphere, unites with this principle, and forms the septic acid, which, being taken up by these earths, converts them into nitrous soils.

In further confirmation of the origin of this acid, may be added the authority of Fourcroy, who says, "It is no longer to be doubted that the salt-petre, which forms itself under our eyes, in soils soaked by vegetable and animal juices, or in stones impregnated with the same juices, or their vapour, (the materials which compose the floors and walls of our stables, vaults, &c.) represent, in this respect, real artificial nitre-beds."†

This acid is also found to exist occasionally in the atmosphere. The experiments of Margraff‡ on snow and rain-water, and Bergman's analysis of waters, prove its presence in the air, from whence

* Nicholson's Chemistry, p. 32.

† Vide Med. Repos. vol. i. No. 1. p. 71.

‡ Vide Watson's Chem. Essays, vol. ii. p. 79.

they are precipitated by these bodies, and mix with them in their descent. The nitrous quality of the calcareous matter of old walls, which takes place to such an extent as to be converted to economical purposes, affords like proof of its presence in the atmosphere.

The bases of the two gases, septon and oxygene, which compose this acid, constitute likewise our atmosphere, but in different proportions and combinations. The septic acid is found to contain four parts of oxygene and one of septon, chemically united; while the proportion of these ingredients in atmospheric air about the mean ratio, are 27 of the former to 73 of the latter; not, however, chemically united, but only diffused through each other, as clay is diffused through water, or as motes are seen passing through sun-beams. These gaseous components of the atmosphere are intimately blended, and mixed together, but do not lose their attraction for caloric, by which they are continued in this state, and for which, in ordinary circumstances, they have a greater affinity separately than for each other. It is by virtue of this attraction for the matter of heat, that they are each kept in a state of gas, and not suffered to unite, and form septic acid, and thereby destroy the respirability of the atmosphere.

Dr. Beddoes remarks, that “the nice balance of attraction between the constituent parts of the atmosphere deserves notice. These two substances, when closely united, form nitrous (septous) acid; if, therefore, they were not, by some circumstances,

prevented from uniting closely, all the oxygene, with part of the azote (septon), would be changed into a highly concentrated acid, and the waters of our globe would be converted into aqua-fortis," (septous acid).* Fourcroy also observes, " that this (septic) acid is composed of the same elements with atmospheric air, only under a different form, and in different proportions, from those which constitute the atmosphere. These facts are indisputably established by experiments in which the nitric (septic) acid is decomposed, and again produced by the union of the original elements. Hence it is demonstrated, that it consists of four parts of oxygene, and one of azote (septon). But these two principles, as contributing to the formation of the atmosphere, are in the proportion of a little more than two parts and one half of the first, and one of the second, and exist in an uncombined state, separately dissolved in a common menstruum, and without the possibility of contracting a real chemical union. Hence it arises, that atmospheric air is never spontaneously converted into nitric (septic) acid."†

The formation of septic acid in the atmosphere seems, however, to take place under certain circumstances; as when the two constituent elements of the acid are brought into close union, and within the sphere of each other's attraction, by some violent concussions, such as lightning in thunder-storms. The experiments made by Mr. Cavendish,‡ who,

* Considerations on the Medicinal Use, and on the Productions, of Facitious Airs, p. 18.

† Vide Med. Repos. vol. i. No. 1. p. 68 and 69.

‡ Chaptal's Chem. vol i. p. 219.

by passing the electric spark through a portion of oxygenous and septic (azotic) gases, obtained this acid, further tends to corroborate this opinion, and leads, at least, to a belief, that this process, to a larger amount, is constantly taking place in the upper regions of our atmosphere, by the intervention of the electric matter.

CHAPTER IV.

Action of this Acid and its Oxyds upon Timber, Metals, Earths, alkaline Salts, and Water.

THE septic acid having been shewn, in the preceding chapter, to owe its origin to animal and vegetable decomposition, its operation on timber, metals, &c. will next be considered.

Facts, sufficiently numerous, prove that this acid, generated by putrefaction, is always on or near the surface of the earth, and from thence, when existing in any considerable quantity, pervades the atmosphere, and, on meeting with certain bodies, unites with them, and becomes fixed or decomposed. If, in its vaporific form, it meets with the woody portion of dwellings, around and in which it is more or less plentifully evolved, more especially the unclean, there can be no doubt but a quantity of this acid is imbibed, as all these materials are porous in a greater or less degree. There are no direct experiments, however, which prove

that there exists a chemical union between the acid and it; but, from the readiness with which wood is penetrated by water, and the known union which this latter body possesses for contagion, it must not unfrequently be conveyed in this manner, and combined with the timber of human habitations, where these gaseous vapours, extricated during vegetable and animal putrefaction, abound: the quantity taken up will, in all probability, be proportionate to the porosity of their texture; and in this ratio may the different kinds of wood be capable of imbibing the acid. The rapid decay and rotting of the timber of such vessels as carry wheat, is further testimony of the union and destructive operation of this acid, on its application to wood. The manner in which this process takes place, appears to be owing to the grain falling through the flooring of the vessel, where, on mixing with the water there commonly present, putrefies.

Wheat, containing the principle of putrefaction in no small quantity, has, during its dissolution, this principle, united with a sufficiency of the oxygen, supplied either by the water, or what it itself contained, to form the septic acid, which, spreading itself, attaches and unites with the timber, causing it to rot and decay, more or less rapidly, in proportion to the strength and activity which the acid attains.

From this disposition of the acid of putrefaction to combine and unite with the woody portions of dwellings, ships, or whatever else it comes in contact with, may it happen, that the noxious matter,

said, in some vessels, to infect each successive crew, derives its poison.

2. The operation of the septic acid, as above observed, in rotting and breaking down the timber of vessels, has been noticed to rust and corrode, proportionally quick, such iron spikes and nails as were exposed, in a similar manner, to the same cause; and, from its corrosive qualities, gradually destroys and wears them away, if present in sufficient quantity, till nothing but rust is left remaining. Such instances as have been collected and examined on this subject, go to prove this operation of the acid on metals. It has been observed, that in the West-India Islands, where putrefaction goes on rapidly, such iron cannon as were exposed to the atmosphere, commonly furcharged more or less with this acid, rusted much sooner than those which had been buried in the sand in salt water. The testimony of Van Sweiten also corroborates the activity and destructive influence of this acid on metallic bodies. He mentions, that at Oczakow, during the plague, “the instruments made use of by the surgeons turned as black and livid as if they had been dipped in aqua-fortis,” (septous acid)—and “the silver hilt of a sword, which, all the time of the plague, hung up in a tent, was changed quite black.”

3. The action of this acid, in respect to earths, is more observed, and takes place to a larger extent. It readily unites with calcareous earth (lime), whenever they come within chemical attraction, in the form of a septite of the same, (calcareous nitre,) as appears from the nitrous quality of old walls of

privies, sinks, drains, &c. Grounds frequently trodden by cattle, and impregnated with their excrements, the walls of slaughter-houses, and the like, where exhalations from putrid animal and vegetable substances abound, as well as the formation of nitrous earths at the bottom of graves in which animal bodies have decayed, puts it beyond dispute, that these earths have an attraction for and unite with this acid. This affinity between the acid of putrefaction and lime, takes place to a greater or less extent in every habitation, more especially in large and crowded cities, where the strictest attention is not paid to remove all filth, and putrefying animal and vegetable materials. It was so well known, as to become an object worthy the attention of a body corporate in Paris, who obtained licence to take away as much of the old mortar of the walls of houses, torn down, as they pleased, for the express purpose of making nitre. Hence may be learned the quantities of septic poison that is present, and floats about the habitations of man, gradually undermining his constitution, and causing malignant diseases, if not taken out of circulation, and combined with some substance.

4. This acid likewise, on meeting with the carbonates of alkaline salts, decomposes them, by destroying the chemical affinity subsisting between them and the weaker acids; while, at the same time, it attaches to itself the alkaline basis, forming with it a septite of the same. The facts already quoted, in the first chapter, put it beyond doubt, that the acid of putrefaction readily unites with

pot-ash, soda, and ammonia, respectively, in the form of septites, wherever they come within the sphere of each other's attraction: and, if it is evident that these bodies enter into combination, there will be no difficulty to shew, that this acid likewise unites with such salts as have an alkali for their base. According to Bergman's tables of elective attractions, the septic (nitric) acid has a greater affinity for pot-ash than for any other alkali; and that no acid but the sulphuric will dissolve their union.* On coming, therefore, in contact with such salts as have this alkali for their basis, it will decompose them, and, from its superior affinity for this latter substance, combine with it in the form of a septite of pot-ash. In the same manner will those salts, having soda and ammonia for their basis, be operated upon by this acid.

5. The presence of this acid in water, and its ready and entire miscibility with this body, is evident from the experiments made, with the utmost diligence and attention, by Bergman and other chemists, on rain and snow water. The testimony of Lewis is further confirmation of this union between the two bodies. He observes, that "common waters, both atmospheric and subterraneous, contain a little of this acid in combination with it;"† and

* Although the septic acid does not possess an attraction for either of the alkalies, in so eminent a degree as the sulphuric, according to Bergman's tables of elective attractions, yet, from his note, it appears it is capable to disengage the sulphuric acid, in some cases, partially, from its connection with alkalies, though not so rapid and entirely as either of the other acids.

† *Materia Medica*, vol. ii. p. 120.

that among the substances commonly found in waters, is the “ nitrous (septous) acid, combined with an alkali into nitre, or with some of the soluble earths into nitrous salts.”* “ The purest of the common waters is that of snow; and the saline matter of this kind of water is commonly of the nitrous kind, composed of the acid of nitre (septic acid), united with calcareous earth.”

It is agreed upon by almost all observers, that the vapours from stagnant waters do seldom occasion much mischief, as long as the mud and slime remain covered. The reason of this is obviously owing to the mud, while covered by the water, emitting its poison but slowly, which, as it arises to the surface, mixes with the incumbent water, and remains united with it, so that little or none escapes to taint the atmosphere. But at length, as evaporation goes on, and the water is nearly evaporated, these fluids, rarefied by heat, and becoming volatile, ascend into the atmosphere, and taint it with their noxious qualities, to the detriment of man and brute animals, who live and move in it. On this miscibility of septic, or acid of putrefaction, with water, no doubt, does it happen, that showers of rain, as observed by almost every writer on the diseases of hot climates, possess such beneficial and salutary effects. The rain, in its descent, meets with this acid, unites with it, and thus precipitates it again to the earth, leaving the atmosphere in a state freed from its poison. In the same

* Vol. i. p. 118.

manner may dews and fogs, in their descent, unite with this acid vapour; and to the gradual and flow precipitation of water from the air, falling through this infectious fluid, and carrying a portion of contagion along with it, does it happen, that the crews of vessels, sent on shore, and sleeping on or near the surface of the earth, in the open air, in such places where these pestilential vapours abound, are so commonly seized with diseases which destroy their lives. The natives of the East-Indies are so well aware of the noxious qualities, at times, of rain-water, which falls first in showers, that they are cautious how they expose themselves to it. As evidence of this atmospherical water containing something deleterious, it has been known to cause foal-leather to become mouldy and rotten in the space of forty-eight hours. The same was also observed to happen in our own city, in the time of the epidemic, in 1795. Hunter also remarks, that exposure to rain is believed to be the cause of fevers in the island of Jamaica. The practice among Europeans at Constantinople, Grand-Cairo, and other places where the plague rages, to cleanse all their goods, &c. they receive by means of water, is further corroboration that pestilential gas unites with water, inso-much that these bodies, thus cleansed, are deprived of communicating any poison they had previously imbibed. To this miscibility of contagious fluids with water, may cold bathing, in malignant diseases, owe its beneficial and salutary effects—the poison which adhered to the skin and its pores being

thereby conveyed off, and rendered harmless to the constitution.

From the preceding facts, then, it may be concluded, that the septic acid, generated in all filthy and unclean dwellings, sinks, &c. on meeting with either of the substances above enumerated, unites with them, becomes fixed or decomposed, and thus taken out of circulation. By this wise provision of nature, the acid of putrefaction, which must be formed in no small quantity, considering the immense and incalculable mass of vegetable and animal matter which is continually undergoing disorganization; is arrested and restrained from assuming its corrosive, stimulant, and poisonous qualities, which it exerts on man and brute animals, when set loose in the atmosphere.

CHAPTER V.

Effects produced by it upon the Constitution of Men, particularly the Mouth, Throat, Alimentary Canal, exterior and pulmonic Surface, Heart, Blood-vessels, and Lymphatic System.

HAVING ascertained, as it is hoped, the cause of most endemic and epidemic diseases, the sources of their origin and formation, together with their affinities and action on different bodies; their effects on the living constitution shall next be considered.

1 and 2. The effects of oxyds and acids of this sort, when applied to the living body, which, in some instances, may be completely surrounded by an atmosphere highly charged with these gaseous fluids, are inflammations or ulcerations, together with many other diseases of different kinds; and, if inspired in a concentrated state, may cause instantaneous death. On its application to the fauces and throat, from its caustic and corroding nature, it may inflame, and excite heat and distressing pain in the surrounding parts, and bring on apthæ, and erythematic affections of the pharynx and œsophagus, as is observed to happen under certain circumstances where it is generated, or present, from any other cause, in sufficient quantity. The experiments of Professor Mitchill,* in his course of lectures, in 1796, on the tartar of the teeth, shews that this acid may be (and is occasionally present in the mouth) either formed from the remains of corrupting food, or taken in, by inspiration, with atmospheric air. This operation and effect, produced by the acid and its oxyd, on the fauces and throat, is further confirmed by facts of diseases of these parts, induced by breathing air highly vitiated with pestilential effluvia. To this effect is the observation of Huxham, who remarks, that “for many months past we had scarce the slightest fever, but it was attended with sore-throat, apthæ, and some kind of cuticular eruption, and that, too, in pleuritic and pneumonic disorders; so greatly did the constitu-

* Vide Mitchill's letter to Thomas Charles Hope, M. D. in the New York Mag. for February, 1797.

tion of the air, &c. seem disposed to produce eruptions in all sorts of feyerish indispositions.”*

Robertson, in his remarks on the Monthly Review of the sick in July and May, also observes, that to the class of fever, the dysenteric belly-ache, and almost all the cough and fore-throat cases, should be added, because they originated, I had nearly said, from the same source; these different appearances depending on the habits or constitutions of the subjects infected.”†

In the pestilential fever which prevailed at Winchester Hospital, many were seized with uneasiness of swallowing, and complained of a soreness of the throat.‡ To this may be added the authority of Chisholm, who, in his account of an epidemic fever in Grenada, remarks, among other observations, that “some complained of a rawness, as it were, from the throat to the stomach;” or, as they expressed it, “a rawness and burning of their inwards.”§

Hence, then, it will appear, that this volatile acid does occasionally enter the fauces, and extends its influence to the œsophagus, causing a greater or less degree of inflammation and uneasiness in the parts, according as the poison is in a more or less concentrated form, and to the length of time it is applied. The mucus which lubricates the parts, and is continually excreted in considerable quanti-

* On Fevers, p. 274.

† On Jail Fevers, p. 325.

‡ Smyth on Jail Fever, p. 12.

§ Med. Com. for 1792, p. 267.

ties, more especially on the introduction of any extraneous body, may, in all probability, defend them from more repeated attacks of this acid, by uniting with, and preventing its coming in contact with the parts.

3. The operation of this acid on the stomach and intestines appears more frequent than the above, and is productive of greater evils and fatality to the constitution. It may be either taken into the stomach by mixing with the saliva, and swallowed, or may be generated in the intestinal canal, on the putrefaction of some of those substances that are taken in for our nourishment. The opinions of the most respectable authorities countenance these modes of operation. The saliva and fluids of the mouth consist principally of water, and may, therefore, be supposed to possess an attraction for these contagious gases. The infection, thus finding its way into the mouth, will almost unavoidably get into the stomach during the deglutition of our food, or be conveyed there with our drink.

Balfour, in a Treatise on Putrid Intestinal Remitting Fevers, ascribes the causes of these complaints to a putrid state of the *mucus lining the intestines*, which, being absorbed by the lacteal vessels, and carried into the blood, causes the febrile state. —“ This mucus receives the infection first by contagious matter taken into the stomach by means of the saliva.”*

To this may be added the authorities of Turner,

Gardiner, and Lind; the latter of whom says, that swallowing the spittle, in infected places, is justly deemed a means of sooner acquiring the taint; for which reason neither the nurses, nor any one else, should be suffered to eat in infected hospitals. "I am apt to think, that infection, from whatever impure fountain it is derived, does first discover itself by affecting the stomach and intestines."*

Another mode in which the diseases depending on the septic acid are generated, is by the putrefaction of those substances taken into the stomach, from time to time, for our support. If it is evident, that animal and vegetable matter, undergoing dissolution in the open air, give rise to the septic acid and its oxyds, is it not presumable, that this same compound will be formed, on the corruption of similar substances, in the *primæ viæ* of human bodies? It is necessary to the maintenance of life, that a proper quantity of food be taken into the stomach, from time to time; and that the digestive organs perform their functions properly; for, as the diet is principally of the animal kind, and, consequently, containing all the elements necessary to the formation of the septic compounds, it would undergo putrefaction in the intestinal canal, were it not prevented by the saliva, gastric liquor, pancreatic juice, and bile, which, mixing with it, dissolve and prepare it for the various purposes it is intended to answer. As long, then, as the stomach secretes its liquors in healthy and due

* On Hot Climates, p. 65.

quantities, will its contents be kept in utter impossibility of forming the septic poison. But when these preventatives are entirely suspended, or weakened, from debilitating causes, such as the too liberal use of spirituous liquors, excessive heat, fatigue, or from any other process by which its healthy functions are destroyed or impaired, then it is evident that the food will be liable to corrupt, and the products formed from these materials, within the stomach and intestines, similar to those which obtain without the body. A source of poisonous effluvia seems thus to exist in our bodies ; and, from its stimulant qualities, the occurrence of nausea, burning pain, and excessive vomiting, together with other symptoms of gastritis, will not be difficult of explanation. To this cause, whether generated in the *primæ viæ*, or taken in from a vitiated atmosphere, when applied to the intestinal canal, are diarrhœas, dysenteries, and cholera morbus, diseases of the same genus, only differently modified, referable. The inflamed state of the stomach, duodenum, and lower parts of the intestinal canal, and the black gangrenous and mortified spots, are all owing to the operation of this acid, which, in some cases, may acquire a higher degree of malignancy than common, by uniting with a larger portion of oxygene. The coffee-coloured matter, commonly called *black vomit*, ejected in what are called *bilious remitting* fevers, seems to owe its colour to a mixture of this acid, as appears from its stimulant nature, noticed by dissection, with a quantity of bile and blood, which is poured out of such vessels as have

their coats destroyed by this poison. That this is not a discharge of putrid bile, is evident from the experiments of Saunders, who observed, that so far from its becoming putrid, it was less liable to undergo this process than any other of the animal fluids, and would even prevent the disorganization of such substances as were immersed in it.* Blood, mixed with bile, became putrid in three days; while no mark of putrefaction manifested itself in the bile till the sixth day.† Hence also it is evident, that putrid bile, which has been assigned as the cause of bilious fevers, has no agency in its production; for if the bile did, in reality, become putrid, this change must necessarily have previously taken place in the blood, in which state the animal must expire within a few moments after putrefaction takes place.

4. On the application of these pestilential fluids, which have been considered the causes of the diseases mentioned, to the bodies of men, which it may completely surround in some cases, is it presumed, are the various eruptions and petechiæ, so common in fevers of the worst type, to be explained; and not often to be referred to critical depositions of humors from the blood. These affections will put on different appearances and malignancy, in proportion to the concentrated state of the poison, the constitution, and parts to which it is applied. From the disposition of this acid to adhere to bed-clothes

* On the Liver, p. 130.

† On the Liver, p. 110.

and bedding, of which there are innumerable instances, it will readily appear how these pestilential eruptions are produced, especially on those parts that are kept constantly covered, as the back, loins, &c. which are thus continually surrounded by an atmosphere of contagious vapours. The skin, thus beset by this fluid, whose particles seem to inhere in its pores, becomes inflamed, and puts on this morbid appearance. The yellow colour of the skin, in some cases of highly contagious diseases, seems to depend upon the same cause, and not to an absorption of bile, as has been supposed by writers on bilious remitting fevers. If these changes of colour in the skin were really owing to absorbed or to regurgitated bile, the colour of the urine, in these cases, ought to be deeply tinged with this fluid; and the faces to put on an ash-coloured appearance, as in jaundice; but none of these appearances are observed to take place in the fevers where this pretended absorption is alledged. Beside, it is well known, that such parts of the skin to which this poison is artificially applied, will put on a yellow appearance, resembling that which is observed to take place in what is called *yellow fever*. It has been observed, that persons sick with this fever, which had been taken in the West-Indies, had that part of their eyes which was, in vision, exposed to atmospheric air, tinged with yellow; while the remainder of the eye retained its natural colour. In this case the eye could not have acquired this colour from an absorption of bile; which, if it had been the case, would also have been evident in

other parts of the eye and body. Were it not, probably, for the perpetual supply of tears, which wash the eyes, and thus convey off any contagious fluids that may be applied, these appearances might oftener occur, as impressions would be quicker observed in this organ than on the skin.

5. This acid, in a vaporific form, does, no doubt, sometimes enter the trachea, with the air, in respiration, where it may inflame and destroy the parts with which it comes in contact; and, in its passage to the lungs, if in a concentrated form, may occasion sudden death. In this manner may the sudden extinction of life, in persons exposed to the contagion of the plague, as observed by Ruffel, be accounted for.* If this gaseous fluid be inspired in such a diluted state as not to occasion immediate death, it may cause catarrhal affections, anxiety, coma, suffocation, &c. depending on the sparse or concentrated form, and circumstances under which it is applied. When mixed with atmospheric air, and taken into the lungs, it will not serve the purposes of respiration, as but a small portion of vital air will be decomposed, owing to the large quantity of non-respirable air which is taken in. The heat of the body must thereby be lessened, and the contractions of the heart and arteries become more slow and feeble. In this way may the purple and blackish spots of persons dead of fever, occasioned by this acid and its oxyd, and the livid and dark colour of the skin, attended with

* History of Aleppo, p. 232.

coldness during life, be accounted for; the lungs not being able to restore to the system its usual and necessary supply of oxygene. Hæmorrhages, debility, and prostration of strength, together with want of cohesion in the solids, might all be explained upon the same principle, the muscles being deprived of their usual quantity of oxygene, and overcharged with septon.

6. If this acid be formed in the stomach and intestines, or taken in by the saliva, and applied to the mouth, fauces, cuticular and pulmonic surface, can it be supposed, that it should not be taken up by the absorbent vessels of the skin and pulmonic organs, or absorbed by the lacteals of the intestines, which are known, in some instances, even to take up some of the fæces, and carried into the mass of blood? That something of a pestilential nature is conveyed into the blood, appears from the evident marks of pestilential infection, which children, born of mothers sick with the plague, bring along with them. Whether they acquired this taint immediately from the blood circulating through the umbilical cord, or from the *liquor amnii*, or both conjoined, is immaterial to our present purpose, as, in either manner, it goes to prove what has been said above. The acid sweats thrown out from the poisoned mass of blood, by means of the small exhalent arteries, in malignant and pestilential diseases, forming the matter of contagion, and adhering to the bed-clothes and linen, which, by its corrosive qualities, it destroys and rots; and, if excreted in any considerable quantity, so commonly re-

lieves the patient ; inasmuch as the volume of poison contained in the arterial system is thereby lessened ; shews that the blood, in certain diseases, contains something of a noxious nature. The appearances also which blood, drawn in pestilential fevers, puts on, correspond with that in which septic gas had been artificially injected.* Blood, thus infected with this poison, taken up by the absorbent vessels, will be carried the round of circulation, and will continue to stimulate the heart and arteries, wearing out their excitability, and, consequently, bring on death, if the constitution is incapable of becoming habituated to its stimulus, or part, or whole, of the stimulus be not subducted. If it be present in any great quantity, it may cause a sudden extinction of the vital principle, as is observed sometimes to happen in highly pestilential diseases.

7. The above-mentioned compounds, when absorbed by the lymphatics, may inflame them, and cause obstructions, indurations, and even suppuration, of those glands through which they pass, as is commonly observed to take place in the inguinal and axillary glands, in the plague, and other diseases produced by a pestilential state of the atmosphere, where it is absorbed in a highly concentrated form. Instances have occurred, where the lymphatics of the hand, on this extremity being wounded, in dissecting bodies, in which the septic acid appears already to be formed, were highly inflamed, and

* Vide Mitchill on the effects of contagion on the heart, in the New-York Mag. for 1796.

could be readily traced from the part where this fluid had been applied, in their course to the glands in the axilla, in which subsequent suppuration took place. Beside the affections of these glands, those of the mesentery will be liable to like ailments; and more frequently, as this deleterious fluid will be more frequently applied to them, by reason of its absorption from the intestines. The septic compounds, passing through the lacteals, will inflame them, and extend to the glands, in their way to the thoracic duct, and bring on an indurated or schirrous state: if it be absorbed in a highly concentrated state, it may also communicate its effects to the mesentery. When these glands become indurated or inflamed, the chyle will necessarily be obstructed totally, or in part, in its circulation through these glands; consequently the system will not receive a supply of nourishment equal to the quantity expended in performing its healthy functions. Hence the body must waste away, and the disease named marasmus be induced. The frequent dropical affections which follow long-continued intermittents, dysenteries, and other diseases of the same class, appear, in many instances, to be owing to obstructions of these glands, which do not allow a free passage to the lymph, which is therefore deposited in the different cavities and cellular texture of the body; and in proportion as the obstruction is more or less universal, will the disease be general or local.

CHAPTER VI.

Application of this Principle to explain the Prevention and Destruction of Infection, or Contagion, in Ships performing Quarantine, in Jails, Hospitals, private Dwellings, in regulating the Police of Cities, in the Management of Lazarettos, &c.

HAVING shewn the operation of the septic acid, on its application to the constitution, we come next to consider its prevention and destruction in ships, performing quarantine, &c. &c.

1. In such ships as have these noxious effluvia floating about, either derived from articles infected, or generated from the collection and putrefaction of such materials as contain septon, it will be proper, from the known affinity which subsists between these contagious vapours and calcareous earth (lime), to expose this substance to an atmosphere thus impregnated. White-washing between decks, and all such places as may admit of this practice, will therefore be the most advantageous method in which it can be applied, as a larger surface will thereby be exposed, and, consequently, a greater portion of the acid taken up and neutralized in a given time. Frequent repetitions of this practice will be necessary where the contagion is abundant, as the lime will become saturated with this principle, and incapable to attract and take out of circulation any more of the noxious compound. In such instances where these effluvia have, for any

length of time, been present in vessels, it is more than probable, that from the capability existing between the two to unite, the timber of the latter may imbibe some of these vapours; and to this, as has been above remarked, may it be owing, that the successive crews of certain vessels are sometimes destroyed. To destroy this connection between these two bodies, as well as to prevent the future ascent of the gas, and thus again taint the circumambient atmosphere, a solution of the vegetable alkali (pot-ash), in water, which possesses the greatest known affinity for this fluid, will be a proper preventative. It will disengage the acid from its connection with the wood, in consequence of this superior attraction, and join with it itself. Frequent washing the apartments will likewise tend greatly to cleanse and carry off the noxious vapours; and will also, by being imbibed into the texture of the wood, set loose and convey away such poison as may remain. Ventilation must not be neglected: the contaminated atmosphere will thereby have part of its volume conveyed off, and a quantity of purer air admitted; thus rendering its stimulating quality less violent and active.

2. The same means, recommended above, for the destruction of these fluids in ships, will apply to jails.—As white-washing the walls with lime can at all times and readily be done here, it ought, from time to time, to be renewed; the poisonous effluvia being thus constantly taken up, and rendered harmless. Washing the apartments with water or ley, which has a still greater affinity for these effluvia, will

disengage the poison which they so commonly become impregnated with, to the injury of the health of the inhabitants of these places. In no one instance will it be more necessary to admit fresh air, than in these places. The pent up vapours will, in a short time, acquire a high degree of malignancy, and cause difficulty of respiration, uneasiness about the precordia, and bring on other symptoms indicative of a vitiated state of the atmosphere.

3. The regulation of hospitals will be answered by the same means already noticed for jails and ships : but, from the specific gravity of this acid or its oxyd, it will occupy the lowermost parts of the rooms. “ Under an atmospheric pressure which supports the quick-silver in the barometer at 29. 84 inches, and in a temperature of 54. 5 of Fahrenheit, a cubic foot of azotic gas weighed one ounce, thirty grains and one half ; and of oxygenous gas, one ounce, one drachm, and fifty-one grains : it is presumable that a combination of the two, that is, thirty-seven parts of oxygene united to thirty-three of azote, would form a fluid of nearly the same weight with atmospheric air, or rather heavier ; and the probability of this would increase, by considering that a cubic foot of nitrous gas, which contains only thirty-one parts more of oxygene than the gaseous oxyd does, weighs one ounce, two drachms, and thirty-nine grains.” Hence, then, persons who lay on or near the floor, where this compound is present, will suffer more than those who walk through these places ; and for this reason also will the atmosphere on the second floor be

more respirable than that on the first, or lowest. Vent-holes, upon a level with the lowermost part of the room, may therefore more readily suffer the escape of these noxious compounds; and, in addition with those substances that take up and neutralize them quickly, restore the purity and respirability of the air.

4. The preventatives already mentioned, particularly for ships, which may be considered as floating habitations of men, will also apply to the cleansing and purification of private dwellings. From what has been said on the affinity of lime with the septic acid, it will, at first view, appear how much more preferable, and conducive to the health of the inhabitants, such dwellings, which have their walls plaistered with this substance, will be, to those of gypsum (sulphate of lime), which is incapable to neutralize the acid. The common practice to prevent and destroy contagion in private dwellings, by means of alkalies dissolved in water, such as ley, &c. and lime, shews how much preferable this management and contrivance is to that of burning tar, coal, sulphur, &c. substances that possess no useful, but pernicious qualities, inasmuch as the pestilential matter resists the attractive powers of these substances. (Vide sect. vii).

5. In regulating the police of cities, it will, at first view, appear highly necessary, in order to prevent the formation of these noxious fluids, to remove all the materials, such as animal and certain vegetable substances, from which they are generated. In addition to the preventatives enumerated for the

prevention and destruction of contagion in jails, &c. planting trees along the streets, especially those which are, from situation, more liable to collections of gases of this kind, will be of service in decomposing these fluids, as soon as formed, if in considerable quantities, and thus restore the air to its former state of respirability. " These very substances (putrefying bodies and street-manure), that cause so much mischief and terror in *cities*, are sought after with great avidity by farmers, who purchase them at a high price, and use them, with much advantage, to fertilize their fields. The beneficial and salutary effects of this practice in husbandry, makes it look as if nitrous acid and nitrous airs were good manures, and that vegetables had the power of decomposing them. That, in short, in the economy of plants, there is a process by which the septon and oxygene of these infectious fluids are separated; and while the former remains in the vegetable as a part of its nutriment, the surplusage of the latter, after forming gum, mucus, meal, &c. and other vegetable oxyds, flies off through the upper surface of the leaves, in company with heat and light, in the form of vital air." (Vide Mitchill on the decomposition of contagious air by vegetation. New-York Mag. for 1797.)

The luxuriant growth of vegetables in the summer and autumn of 1795, in New-York, during the epidemic, makes it further evident, that vegetables decompose this noxious body, and thus act in a beneficial and salutary manner. Upon this principle in vegetables to destroy the chemical

union between the ingredients of septous airs, may the dangerous consequences often attending the cutting down of woods in new and uncultivated countries, be accounted for. The exhalations from the swamps, morasses, &c. being set loose in greater quantity in the atmosphere, by the now more direct rays of the sun, without any adequate supply of other vegetable substance to arrest and decompose them, they ascend, and pervade the air, carrying on their usual noxious and deleterious qualities, on meeting the bodies of men, or brute creation.

6. The management of lazarettos may be conducted upon the same principle. From the known miscibility of contagion with water, and the short distance these fluids extend their influence over this body, as has been repeatedly observed by Lind, and others, the most proper and healthy situations for institutions of this kind, are readily pointed out. And,

7. According to what has been said in the fifth chapter, concerning the production of contagious fluids in the stomach and intestinal tube, from animal and certain vegetable food, taken in from time to time, it will appear, that such substances as contain septon to any amount, such as lean and muscular animal substances, are improper ingredients in diet. Such articles, then, as contain none of this principle, ought to be selected as the most proper for nourishment in complaints occasioned by this acid. Fat or oily substances being of this class, and vegetables containing but little septon, ought to be the most beneficial and wholesome diet in ma-


lignant and pestilential diseases. This is authenticated by facts sufficiently numerous to put it beyond cavil.

The comparative health, in the West-Indies, between the English, who indulge in the free use of animal food, and the French, who, on the contrary, abstain from this kind of aliment, and live principally on vegetable food, shews that animal matter is not only improper, but is an injurious article in our diet, in all pestilential conditions of the atmosphere, or when malignant diseases prevail. The same is observed to happen in Bengal, and other parts of the East-Indies. The English, who live principally on animal and vegetable food, are far more liable to attacks of malignant diseases, and a greater number of them are carried off annually thereby, than of the Gentoos and Brahmans, who live on rice. Beside, it is well known how much less fatal the *yellow fever*, and other species of malignant diseases, are among the negroes of the West-Indies, and those of the southern states, who live on vegetable food for the most part, than among the whites of these places, who are under no necessity of abstaining from the use of animal food.

APPENDIX.

EXPERIMENT I.

I TOOK two mice; one I caused to be stung by a wasp, which was immediately thrown into convulsions, and expired in two minutes: into an incision made in the muscular substance of the other, I injected two drops of the nitrous acid; it seemed to operate exactly in the same manner as the sting of the wasp, and the animal expired immediately. On opening them, and endeavouring to stimulate the muscular substance of their hearts, I found it had in a great measure lost its irritability. Fontana observes, in his book upon Poisons, that the nitrous acid, applied to the muscular substance of a pigeon, killed it immediately; Cavendish and Lavoisier have proved, by experiments, that the azote is the radical principle of the nitrous acid.



EXPERIMENT III.

I took four young puppies: into the jugular vein of one, I injected four drops of the decoction of white helebore; into the second, I injected four

drops of the digitalis; into the third, I injected one grain of the salt of urine dissolved in water; the fourth I caused to be stung by two wasps; the first died almost instantaneously; the second and third in less than five minutes; the fourth recovered with great difficulty, and seemed to throw off the disease by foaming at the mouth.

EXPERIMENT IV.

I caused a number of earth worms to be stung by bees, ants, and other insects, which always killed them immediately; and seemed to act on them in the same manner as the decoction of the poisonous plants, the laurel, tobacco, opium, &c. This effect is astonishing, in these animals, which, when cut into pieces with the knife, still retain their irritability for many hours, or even days.

All poisonous plants with which we are acquainted seem to act in the same manner when injected into the circulating system of animals; yet, from the nature and construction of the stomach of some animals, they are eaten with impunity: goats will grow fat upon euphorbium, and swine upon henbane, &c.

THE END.

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